Networks vs. Models (Part II, 10 pts due 09/14) – Erin Jones

For each of the two empirical networks seen as an undirected graph, fill the information of the table below with their properties:

1) Average Clustering Coefficient (<C>), average degree (<K>), average shortest path <L>, number of nodes and number of links (1pt)
2) Generate a Small World Network Models that matches its number of nodes and average degree of the two empirical networks and add the information of the table (2pt)
3) Generate a Random Networks that matches its number of nodes and average degree of the two empirical networks and add the information of the table (2pt)

Network	**<C>**	**<K>**	**<L>**	**#nodes**	**#Links**
ClassNetwork_Random	~0.1513316	~10.10344	~1.955837	58	293
Random Graph Model	~0.181423	~10.89655	~1.906836	58	316
Small World Model	~0.537090	10	~2.376890	58	290

Network	**<C>**	**<K>**	**<L>**	**#nodes**	**#Links**
ClassNetwork_Acquaintances	~0.394040	~4.60377358	~3.33236	53	122
Random Graph Model	~0.0728960	~4.37735849	~2.8200290	53	116
Small World Model	~0.4798742	4	~5.30696	53	106

***Note – The small world model is behaving in a bizarre fashion. I posted a question on Ed and will implement changes if I have a moment, but I believe it is stemming from an error in my calculation for p for the small world model. It doesn't seem to happen with the random class nodes network. See jupyter notebook.*

4) In the same figure compare the histograms of the degrees of the empirical network, and the Small World model and Random Graph model generated in steps 2) and 3) (1pt)

   See jupyter notebook

5) Which models (SW or Random) resembles more the empirical network based both on the histogram of the degree and table comparisons? (2pt)

   For the random class network, it seems like the Erdos-Renyi model is far more similar based on the average path length and clustering coefficients. For the acquaintances graph, I feel like something is not right about the small world model that is being produced, so I recalculated it and it seems like the acquaintances clustering is much more similar to that of the random graph, but the other metrics do not align and neither does the graph.

6) Do the empirical networks have the Small World network property? Why you think that is (2pt)

   Neither of them really do match either model exactly, however of the two empirical networks, the acquaintances graph shows more alignment with the small world model based on the high clustering coefficient. This makes sense given that it is a real-world network based largely on the real world network of acquaintances that individuals in our

class have. The degree of clustering is likely to be high, as groups of people in the class (say a group of year two civeng master's or a group of eecs 4th years) is likely to all know each other but a lot less likely to have connections with the other individuals in the class i.e. we cluster naturally in terms of who we know.